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UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

A SECOND REPORT CONCERNING THE BARK BEETLE OUTBREAK
ON KOSCIUSKO ISLAND

by
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NOVEMBER, 1946



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This report is in the nature of a detailed supplement to the preliminary report dated August 5, 1946. It concerns the findings of I. H. Jones and C. H. Armstrong of the Forest Service and R. L. Furniss of the Bureau of Entomology and Plant Quarantine, during the period November 9 to 27, 1946.

The objectives of the survey upon which this report is based were twofold: (1) To determine the extent of the damage already caused by the Sitka spruce beetle (*Dendroctonus obesus*) and (2) to determine the probable course of infestation. The first of these objectives was attained with what is believed to be a reasonable degree of accuracy. The second proved to be too involved an undertaking to arrive at any hard and fast answer in the limited time available. Consequently, the information obtained indicates possibilities rather than probabilities. Even so, it is felt that the findings warrant positive action concerning the affected stand.

Methods and Accomplishments:

As soon as it was determined that a survey of the situation on Kosciusko Island would be undertaken this year, the project was immediately organised and the field work gotten under way. It was decided that three major activities would have to be depended upon to yield the desired information. In the order of execution it was proposed to:

(1) Fell and analyze a series of attacked trees to determine the character and relative vigor of infestation on a year of attack basis. This work was also to aid in dating the origin of attacked trees encountered in the cruising work, and to aid in detecting recently attacked trees with green foliage but with no insects in the base.

(2) Make an aerial reconnaissance to delineate the boundaries of visible infestation, to pick up any outlying infestation, to determine where the ground survey would be most effective, and to aid in interpreting the ground cruise.

(3) Make a ground survey to determine the amount and nature of the kill, and to determine the ratio of the 1946 to the 1945 attacks as a basis for forecasting the probable course of infestation.

Because of the lateness of the season, and other circumstances beyond the control of the investigators, the actual conduct of the work was practically the exact reverse of that intended. Fortunately a preliminary aerial reconnaissance was made on August 15 by C. W. Archibald and I. H. Jones. This preliminary survey was of great help in effectively organizing the ground survey until it was possible to make a second and more detailed aerial survey.

A total of 959 chains of sample strip two chains in width was run by the compass and pacing method (see accompanying map for exact location of strips). This sample comprised 191.3 acres or 3.0 per cent of the 6,119 acres of merchantable spruce, spruce-hemlock, and hemlock-spruce types actually sampled. All living and dead spruce 30 inches and over in diameter above the butt swell were measured and recorded as to location. Snags down to 50 feet in height were included in this tally. In all a total of 5,139 M.B.M. was recorded on the sample strips. Of this amount, 27.5 per cent was dead and 21.3 per cent recently dead. The detailed summary is given in table 2.

An attempt was made to date the recently dead trees both on and immediately adjacent to the strips. This was a "blind" undertaking since the habits of the Sitka spruce beetle and the rate of deterioration of Sitka spruce in Southeastern Alaska are but little known. Consequently, little confidence is felt in the figures farther back than the year 1945, and no great significance should be attached to them. The 223 trees that were dated break down as follows: 1946 attacks - 17 (7.6%); 1945 attacks - 71 (31.3%); 1944 attacks - 94 (42.2%) and 1943 attacks - 41 (18.1%).

No attempt was made to obtain a sample that would reflect "average" conditions throughout the infested area and the data definitely should not be considered in that light. Stands containing a high percentage of spruce were given chief attention since such stands seemed to be most heavily infested. Strong emphasis was also given to determining whether the beetles had materially extended their zone of infestation. Consequently, considerable strip was run outside of what proved to be the infested area. Only enough strip was run in the heavy and medium infestation to give general figures on the percentage of kill. Considerable reliance was placed upon general observations to determine whether individual strips were typical and also to arrive at the general mortality figures. It is felt that the extent of the losses has not been overestimated.

The aerial reconnaissance was made on November 17 in a Bellanca pontoon monoplane flying at about 90 miles per hour. This plane was suitable for the work but a slower plane would have been preferable. Visibility was excellent with conditions optimum except at the higher elevations where snow covered the trees. Greatest difficulty from snow was encountered in Sections 1, 6, 7, and 8. The area was grid-ironed north and south, and east and west, as nearly as possible on each section line. One turn was made over the Davidson Inlet area.

east of Camp 4. Infestation was sketched in place on individual 4-inch-to-the-mile maps by Jones and Furniss. Special attention was given to delineating areas that were in doubt. The aerial survey, corrected in minor degree by the ground work, was depended upon for determining the boundaries of the infested areas.

The trees that were felled and analyzed were largely intermediate as to size and quality. Eighteen of them were 500 to 520 year old trees of merchantable quality; two were 275 year old scrub trees characteristic of the beach type. All were very slow growing with some having put on but one inch of radial growth in the past 100 years. They ranged in diameter from 19 to 47 inches above the butt swell and averaged 36 inches. Ten of them were "brown tops" (trees that were attacked in 1945 and had shed their needles leaving the brownish outer twigs that give these trees their characteristic appearance). The remaining ten trees were "green tops" (trees largely attacked in 1946 and containing brood, but which had not yet changed their normal color). Time and personnel did not permit the felling and analysis of any of the really large trees that contain a high percentage of the quality volume on the area. It is believed, however, that the brood conditions in such trees does not differ materially from those found in the larger of the trees that were studied. Since the bark was solidly frozen to the trees only general notes could be made as to the success or failure of attacks and the relative abundance of the brood.

What the Beetles have Done

Beginning about 1941 and continuing to the present the Sitka spruce beetle has killed approximately 35½ million board feet of merchantable spruce out of 122 million board feet as of 1943 on some 6,000 acres (see table 1). In addition there has been an individual tree and small group loss that has been in progress for many years. This older loss accounting for 5 to 10 per cent of the standing stems is more pronounced on the Survey Block than on the areas to the west and north. A further point of interest is that a local center of recent kill has developed in the vicinity of Davidson Inlet - not shown on the map. This outlying kill appears to be of medium intensity and of limited extent. Aerial reconnaissance on August 15 did not reveal any significant infestation on nearby Heceta Island.

Three degrees of infestation were recognized, as follows: heavy (60% dead), medium (30% dead), and light (15% dead), see accompanying map, which is a composite of all available information regarding the extent of the outbreak. The boundaries of the variously infested areas are not hard and fast but tend to merge gradually, one into another. Within any one type there is considerable variability as to the degree of infestation. It is for this reason that the mortality percentages have been applied on a broad basis rather than on a section by section basis. Furthermore, the ground sampling was not intensive enough to warrant loss estimated by individual sections.

The area of heaviest infestation begins about in Section 30, T. 67 S., R. 76 W., reaches approximately one mile inland, and extends southwestward to Section 23, T. 68 S., R. 76 W., and the vicinity of Cape Pole. A fringe of heavy kill extends 3 miles northward along the beach to the mouth of Shipley Bay. Heavy kill is also present on the Barrier Islands seven miles farther north. The timber is of high to very high quality with the best of it being in Sections 1, 11, 12, 14, and 23. The trend of infestation seems to have been toward the south; however, some infestation is current throughout the area. Within the general area of heavy infestation there are considerable stands where practically all of the merchantable spruce has been killed. Also, there are pockets where sizeable amounts of green timber remain. The stand on the heavily infested area as a whole has been depleted to the extent that the remaining green timber is no longer operable unless removed in conjunction with a salvage operation.

Four pockets of medium infestation were recognized and mapped. The one in section 11 is small and surrounded by heavy infestation, and for all practical purposes can be lumped with the heavy kill. The remaining three centers of medium infestation, one in Section 7, another in Section 8, and the third in Sections 13, 18, 23, and 24, are of significance in that they may be nuclei around which further heavy losses will develop. For the present they do not represent a critical salvage problem.

The area of light infestation, comprising a band of variable width bordering the "heavy" area and including a small isolated center in Section 2, T. 69 S., R. 76 E., contains more acreage and supports more timber than the other two types combined. Infestation on the "light" area is spotty. It ranges from practically nothing, as in part of Section 26, to rather heavy kill adjacent to the "heavy" area. It is noteworthy that infestation in Sections 2, 17, and 20 is currently active with small groups fairly common. Infestation in these sections may be a local flareup incident to logging, or it may mean that the outbreak is developing on the Edna Bay side. It certainly indicates that the situation there should be kept under close observation in the immediate future.

Infestation Characteristics:

General observation revealed no particular distinguishing characteristics between the green trees and those chosen by the beetles, other than a slight difference in size. The average green tree recorded was a 16 inch, 4-log tree and the average beetle-killed tree was a 4½ inch, 5 log tree. Had the smaller trees been taken into account, the larger size of the beetle-killed trees would have been somewhat more pronounced.

It was thought that the "brown tops" would be largely abandoned by November and that the "green tops" would contain the bulk of the active brood. It developed that both types of trees contained abundant brood. The "brown tops", except the smaller ones with notably thin bark, contained an abundance of overwintering adults in apparently normal condition and ready to emerge and attack early next season. This indicates that many, if not all, of the beetles require two years to develop to maturity in Southeastern Alaska. The "green tops" were of two types, the majority with successful brood (larvae, pupae and new adults), and some with brood in various degrees of pitchng out. Infested lengths ranged upward of 100 feet with brood production generally good except in the tops where the bark was thin. This feature is of importance in that tops left in the woods during logging would produce little brood.

Among the successful brood trees, no marked differences between the 1945 and 1946 attacks could be distinguished as a guide in forecasting the probable course of infestation. Both appeared to be producing equally good broods. There were very few evidences of insect parasites and predators; hence, natural control from that source is not anticipated. The relative abundance of the "brown tops" and "green tops" could not be determined with any degree of certainty, because the Sitka spruce beetle characteristically attacks well above the base. This habit makes it impossible to recognize many of the newly attacked trees before they fade. There has as yet been very little fading of trees attacked in 1946. Thus the marked difference in the number of 1945 and 1946 trees, as recorded on the strips, may well reflect only the spotter's inability to recognize trees attacked in 1946. In this connection it should also be pointed out that many of the trees recorded on the strips as 1944 trees are likely to have been attacked in 1943. The impression from general observation is that the number of trees killed in 1945 was fully as great as for any prior year during the outbreak. It should be kept in mind that all such trees still contain brood that will emerge in 1947.

Origin of the outbreak still remains in doubt. In the report of August 5 it was stated as likely that the outbreak developed in wind-thrown timber. Further consideration renders this surmise less likely. Apparently the outbreak began to develop about five years ago. Since the known areas of windthrow are much older, it now appears that the infestation may have developed in the standing timber as a result of its extreme overmaturity and the relatively dry site upon which it is growing.

What the beetles may do:

Forecasting what insects will do a year or more in advance is at best an uncertain undertaking - something like forecasting the weather. In fact, what happens may hinge largely on the weather. On Kosciusko developments seem more likely to be determined by the vigor of the host tree, Sitka spruce, and the amount of beetle population. On both scores the prospects are that the outbreak will continue. The trees are far past maturity and evidently are readily overcome by the beetles. Also, there is a sizeable beetle population, some ready to attack in 1947 and some developing for 1948. It would be well to be prepared for the worst.

Recommendations:

1. Control by the ordinary direct methods is impractical under the conditions on Kosciusko Island; hence, is not recommended.

2. Salvage, entirely apart from the matter of utilizing much high grade spruce that otherwise will soon be lost, offers considerable promise of cutting down the insect population. The greatest immediate reduction of beetle population can be effected if salvage is directed first against the heavy centers of current infestation now present in Sections 14 and 23. Even if the outbreak continues to develop, the opening of the area to salvage will facilitate the logging of other areas that may develop heavy infestation. Salvage is recommended.

3. If salvage is undertaken, it should be initiated without delay, for some of the trees have been dead for five years or longer and will soon become unmerchantable.

4. The Davidson Inlet area should be examined on the ground at an early date.

5. Ecate Island, Tumekan Island, and other areas where there are large concentrations of spruce should be examined from time to time for developing infestation. In this connection the potential importance of small groups of active infestation should not be overlooked.

6. An investigation of the biology and control of the Sitka spruce beetle is recommended as an important phase of the long term management of spruce in Southeastern Alaska.

Special Considerations:

The question has been asked whether the infestation on Kosciusko is a threat to the spruce on not far distant Hecate Island, once the beetles run short of food where they are now. About the best that can be said on that score is that the possibility exists, for species of Dendroctonus in general are strong fliers. It seems more likely that outbreaks develop in place. Once conditions become right for the beetles, there probably are enough of them wherever their host occurs to increase rapidly to epidemic proportions.

The question has also been asked whether the rafting of infested logs past the Queen Charlotte Islands in summer would be a threat to the valuable spruce stands on those islands; also whether special precautions should be taken to minimize such a threat. This is a "one chance in a million" possibility that the entomological author of this report would discount. A large part of each raft would be submerged, handling the logs in salt water would likely destroy many of the beetles, beetles that did emerge in transit would be at a disadvantage in taking off a low lying raft, they would not all take off in a bunch, and at best they would have a long way to fly. Should conditions on the Queen Charlotte Islands become right for an outbreak, the resident population of beetles would not need any outside help. As long as conditions are not right for the beetles, an invasion of foreign beetles, even if it reached the shore and the forest beyond, would have little prospect of success.

December 5, 1946.

R. L. FURNISS, Entomologist

IVAN M. JONES, Logging Engineer

TABLE 3 - SUMMARY OF SITKA SPRUCE LOSSES ON AN AREA BASIS

HEAVY INFESTATION

Block or Section	Acreage	Merchantable Total B F		Per cent Dead	Volume Dead
		Volume	Dead		
Hungry Block	277.0	5,110,000			
Sec. 1, T. 69 S., R. 75 E.	216.5	4,674,500			
" 11,	376.5	4,243,000			
" 12,	283.5	5,055,000			
" 14,	390.0	6,121,000			
" 23,	340.5	7,114,500			
Subtotal	1,384.0	32,638,000	60		19,592,800

MEDIUM INFESTATION

Sec. 7, T. 69 S., R. 76 E.	20.0	455,000		
Sec. 8 "	212.0	5,828,500		
" 18 "	16.0	1,277,500		
" 13 "	203.0	5,538,000		
" 14 "	97.5	1,530,000		
" 24 "	192.5	4,041,000		
Subtotal	778.0	16,698,000	30	5,009,400

LIGHT INFESTATION

Last Chance Block	447.0	7,000,000		
Sec. 6, T. 69 S., R. 76 E.	95.0	1,034,000		
" 7,	558.5	9,415,000		
" 6,	108.0	2,004,500		
" 17,	500.0	12,402,000		
" 18,	182.5	2,413,500		
" 19,	41.0	453,500		
" 20,	313.5	9,705,000		
" 2, T. 69 S.	211.0	3,119,000		
" 12, T. 69 S., R. 77 E.	346.5	6,178,500		
" 13,	263.0	5,821,500		
" 23,	85.0	1,308,500		
" 24,	192.5	4,041,500		
" 25,	86.5	1,247,000		
" 26,	334.0	6,372,000		
Subtotal	3764.0	72,515,500	15	20,892,250
Grand Total	6189.0	121,851,500	29	35,469,450

TABLE 2
Summary of Board Foot Volume of Spruce on all Sample Strips

DAB	Green		Dead		Recently Dead		Living & Dead	
	No.	Volume	No.	Volume	No.	Volume	No.	Volume
				900		900		900
26								
30	86	100620	16	18720	13	15210	102	119340
32	69	133170	13	25090	9	17370	82	158260
34	47	106220	7	15820	3	6790	54	122040
36	60	151800	13	32890	9	22770	73	184690
38	54	156440	17	48620	12	31320	71	203060
40	39	125190	20	64200	14	44940	59	189390
42	25	101360	7	27700	4	15640	32	129080
44	45	201680	11	51810	8	37680	56	253490
46	30	149610	9	14100	6	30270	39	193710
48	46	281010	15	91980	9	55660	61	372990
50	18	126120	15	107850	12	86280	33	234270
54	43	367470	18	154500	14	122220	61	521970
58	35	354240	17	171930	14	145320	52	526170
62	33	394650	17	201670	12	144300	50	596320
66	24	333320	7	97790	6	83820	31	431110
70	19	300410	10	159300	9	143370	29	459710
74	7	125440	5	89600	5	89600	12	215040
78	4	79880					4	79880
82	1	21800					1	21800
86	1	23650					1	23650
90	4	102120					4	102120
Total	690	3,734,520	218	1,404,470	160	1,096,450	908	5,138,990
Percent		72.7		27.3		21.3		

TIMBER RECONNAISSANCE SURVEY

KOSCIUSKO ISLAND

TONGASS NATIONAL FOREST

ALASKA

1941

Scale : 4 inches = 1 mile

Timber types from Aerial Photographs.

Estimates by Reconnaissance and Circular Plots

Topography estimated and sketched.

SITKA SPRUCE BEETLE INFESTATION

NOVEMBER - 1946

LEGEND

-  Heavy Infestation (60%)
~~Sitka Spruce Mature~~
 -  Medium Infestation (30%)
~~Sitka Spruce Immature~~
 -  Light Infestation (15%)
~~Western Hemlock Mature~~
 -  Muskeg
 -  Windfall Area
 -  Cut Over
 -  Scrub
 -  Type Lines
 -  Block Boundary Lines

